

NOTES ON THE POPULATION OF *LUPERINA NICKERLII LEECHI* GOATER (LEPIDOPTERA: NOCTUIDAE) AT ITS SITE IN CORNWALL, 1987 TO 1989

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INTRODUCTION

Luperina nickerlii (Frey.) (the sandhill rustic) has four distinct populations in Britain. The nominate subspecies is found in Essex, and there are three subspecies living in coastal areas in North Wales and Lancashire, in Ireland, and in Cornwall. The subspecies in Cornwall is *Luperina nickerlii leechi*, which was discovered in 1974 (Goater, 1976) on a strip of shingly sand about 500 metres long and 240 metres wide. The moth has silvery grey forewings marked with a dark brown median band. The subspecies in North Wales (*gueneei* Doubl.) is paler, whilst the Irish subspecies (*knilli* Boursin) is dark brown. The nominate species is widespread over Europe, with two subspecies *graslini* (Obth.) and *tardenota* (J. Joan.) (Leraut, 1980). Some examples of *Luperina nickerlii nickerlii* were taken at Bradwell in Essex which were originally thought to be migrants, but it has now been shown that the species is resident from Canvey Island to Harwich (Emmet & Pyman, 1985) and the Isle of Sheppey (Skinner, 1985). It may be that *L. nickerlii* migrates, as an unnamed subspecies was found at Farringdon on 22.ix.1950 (Goater, 1974) and a single female (the nominate form) was found at Bude in Cornwall on 6.viii.1990 by David Wedd and exhibited at the 1990 BENHS exhibition (Wedd, 1991).

An account of the biology of *Luperina nickerlii leechi* is given in Heath & Emmet (1983). The owners of the site have requested that its name and location be kept secret.

AIMS AND METHODS

The aim was to estimate the population and distribution of the adult stage of *Luperina nickerlii leechi* at its site in Cornwall.

Population counts of moths are usually made with mark/release/recapture schemes, using light traps as the means of capture. This method works very well with moths that fly, but, by repute, *L. nickerlii* rarely flies and does not come to light. The habitat was divided into 14 areas of equal width, marked off with bamboo poles, and the position of each moth was recorded. The moths could be seen at night resting on the stems of the foodplant, *Elymus farctus*, and were easily caught. The best method was to kneel on the shingle, getting down to 'moth-level', and to sweep the area with a powerful quartz-halogen searchlight. The moths were easily seen this way, especially when the searchlight reflected in their eyes. Each moth caught was marked on its forewing with red felt-tip pen. Each mark on the wing represented a different number (1, 2, 4, 7, 10, 20, 40, 70, 100, 200) according to its position, so that up to 454 moths could be individually marked. The number of males, females and pairs was noted and all recaptures were recorded. In the first year, the whole habitat was searched, including those areas without the foodplant. The habitat was too large to search in one night. On two occasions (24 & 25.viii.1987 and 28 & 29.viii.1987), the whole of the area was searched on two successive nights in order to get an idea of the total population.

In 1988, two attempts were made to attract the moths to light, on 4.ix.1988 using a portable Heath trap and on 7.ix.1988 using a 125-watt m.v. lamp on a white sheet.

RESULTS

Table 1. Numbers of *Luperina nickerlii leechi* on site, 1987-1989.

Year	Males	Females	Pairs	Total
1987	47	28	0	75
1988	35	34	9 (= 18 moths)	87
1989	64	145	0	209
Total	146	207	9	371

Table 2. Numbers of *Luperina nickerlii leechi* throughout season, 1987-89.

Date	1987		1988			1989		Total
	Males	Females	Males	Females	Pairs	Males	Females	
14.8	2	0	0	0	0	0	0	2
19.8	5	0	—	—	—	—	—	5
20.8	—	—	0	1	—	—	—	1
24.8	4	2	—	—	—	—	—	6
25.8	3	0	—	—	—	1	5	9
26.8	—	—	1	1	0	—	—	2
28.8	7	4	—	—	—	—	—	11
29.8	9	4	—	—	—	19	33	65
30.8	—	—	—	—	—	25	44	69
31.8	—	—	—	—	—	18	56	74
2.9	9	11	8	4	4	—	—	36
3.9	4	1	8	17	5	—	—	35
4.9	—	—	17*	4	0	—	—	21
7.9	—	—	1	7	0	—	—	8
8.9	3	4	—	—	—	—	—	7
9.9	1	2	—	—	—	0	5	8
15.9	—	—	—	—	—	—	1	1
19.9	—	—	—	—	—	—	1	1
24.9	—	—	—	—	—	1	0	1
28.9	—	—	—	—	—	0	0	0
3.10	—	—	0	0	0	—	—	0
TOTAL	47	28	35	34	9	64	145	371

—no search that night; 0, search took place without any captures; *16 to light.

The numbers seen are recorded in Table 1. Numbers found varied from year to year, the largest number (209) being found in the hot, dry summer of 1989. In 1987, 75 moths were found in a total of 41 hours 40 minutes (an average of 33.33 minutes per moth found), but it should be noted that the whole habitat was searched in 1988, most search time was spent in the most productive areas and 71 moths (excluding 16 moths to a light trap) were found in 10 hours 17 minutes (an average of 8.69 minutes per moth). In 1989, 209 were found in 12 hours 21 minutes (an average of 3.5 minutes a moth). Not only were moths easier to find in 1989 they continued later into September (Table 2), at least until 24.ix.1988. The earliest moths recorded were in 1987, on 14th August, with peak numbers on 2.ix.1987, 3.ix.1988 and 31.viii.1989 (when 74 were seen). The central part of the site (with a large area of *Elymus farctus*) was the most productive throughout the 3-year survey (115 moths being recorded in one of the 14 subdivisions).

In 1987, the whole habitat was searched twice for moths. On 24.viii.1987, 6 moths were found (4 males, 2 females) in half the habitat and 3 moths (all males) in the other half on the following night (9 moths in total). On 28.viii.1987, 11 moths were found (7 males, 4 females) in half the habitat and 13 moths (9 males, 4 females) in

the other half. The population on these two nights may have been as low as 24. In 1988, the whole habitat was searched twice; 20 moths were found on 2.ix.1988 and 35 moths on 3.ix.1988. In 1989, only the most productive areas were searched; 69 moths were found on 30.viii.1989 and 74 moths on 31.viii.1989.

The relative emergence dates of males and females is shown in Table 2. In 1987, the first males were found 10 days before the first female, whereas in 1988 a female was found 6 days before the first male. In 1989 females and males were found together. Males formed 62.67% of the total in 1987, 50.57% in 1988 but only 30.62% in 1989.

The number of recaptures was very low. There was 1 recapture (a male) in 1987 out of 76 moths, 6 recaptures (4 males, 2 females) in 1988 out of 87 moths and 1 moth was recaptured twice. Six of these recaptures were at light (2 to tilley lamp, 4 to the Heath trap). Four were recaptured on the following night, 1 was recaptured on the same night, and 1 was recaptured 2 nights later. There were 5 recaptures (1 male, 4 females) in 1989, 1 on the same night, 4 on the succeeding night. One male with crumpled wings was captured at the same place the following night and may not have moved in this time.

On 4.ix.1988 39 moths were caught in the Heath trap placed near the centre of the site. The slight wind (possibly force 2) decreased during the night. The minimum temperature was 13.5°C at 06.45 a.m. *L. nickerlii* was the most common moth caught, with 1 recaptured female, 3 recaptured males and 16 fresh males, 2 of which were darker than usual. The next most common moth was *Luperina testacea* (O. & S.) (15 caught). On 7.ix.1988, an m.v. lamp was run on a white sheet from 22.50 p.m. to 12.10 a.m. No *L. nickerlii* were caught. Several Diptera and Trichoptera were attracted to the light, as well as crawling opiliones, in addition to the moths *Autographa gamma* (L.), *Tholera decimalis* (Poda), and *Luperina testacea* (2).

DISCUSSION

In many mark/release/recapture schemes, such as Bailey's triple catch method and the Lincoln index method, the population is required to be well mixed after marking before population estimates can be made (Southwood, 1978). These methods provide an estimate of the total population, including those moths present but not seen. As the moths rarely fly, mixing the *L. nickerlii* population was difficult and these methods were unsuitable. One moth was seen the following night apparently not having moved. Marking the specimens provided an actual habitat count, with no estimate of possible total numbers.

The totals of 75, 87, 209 for the years 1987-1989 are numbers recorded. The actual totals in these years may have been much higher. The colony was only sampled on a few nights during the flight period, e.g. in 1987 the colony was sampled on 10 nights in a flight period of at least 27 nights. The population may have been three times higher than recorded. The flight season is a long one. The first and last sightings were 2 males on 14.viii.1987 and 1 male on 24.ix.1989.

The number of recaptures (12 in 3 years) was too low for any estimates of population size to be made from these figures. Six of the recaptures were to light. The low recapture rate is puzzling and there are several possible explanations. (a) The moths may have a very short lifespan. One moth caught in 1988 was recaptured twice and was the only moth shown to live for over 2 days. (b) A high proportion of those moths present could have been overlooked, including marked specimens (my technique improved with practice), however, the marked moths were easier to see than the unmarked ones. (c) The survey methods may have affected the results and marked moths may have been more prone to predation. (d) Some moths may have migrated

or have been blown by strong winds from the site. This is unlikely, as the species seems well adapted to its wind-swept habitat.

Numbers found varied from night to night (dropping from 35 on 3.ix.1988 to 21 on 4.ix.1988). Emergence rates might be erratic and vary according to unknown factors. Strong winds may keep moths clinging to *Elymus farctus* stems, but fewer moths (20) were caught on 2.ix.1988 in a strong wind than on 3.ix.1988 in a light wind (35 moths caught). Peak numbers (74) were found on 31.viii.1989, when only the most productive areas were searched, and the total population was probably higher than this.

Between 1987 and 1989 total numbers increased considerably (from 75 to 209). Part of the habitat had been affected by construction work in 1986, when a large area of *Elymus farctus* had been bulldozed away. By 1989, *Elymus farctus* had recolonized this area and moth numbers here increased from 12 (16%) in 1987 to 101 (48.33%) in 1989. The population of *L.n. leechi* seems to vary from year to year. Details of moth records provided by Colin Hart show that 60 moths were found on 23.viii.1975 and on 28.viii.1984, whilst 50 moths were recorded in under 30 minutes on 29.viii.1981. In 1976, G. Senior recorded about 150 moths in 1 hour. I know of no records for 1980, when according to Colin Hart little vegetation was visible. The subspecies seems to do well in hot, dry summers such as 1976 and 1989.

With several moth species, it is usual for the males to emerge before females and for males to be more common than females. However, with some species living in difficult environments or when the females fly little or are immobile, the females may emerge first (Novak, 1980). In 1987 2 males were found 10 days before the first female, but in 1988 a female was found first. In 1989 females and males were found together, and no pattern can be read into these figures. The proportion of males seen declined between 1987 and 1989. The totals for 1988 include 16 males caught at light. If we subtract this catch from the 1988 total, the proportion of males in 1988 (32.18%) is close to the 1989 proportion (30.77%). These figures do not include flying moths, many of which are likely to have been males. Further research is needed to establish the mean ratio of males to females.

In 1988, 21% of the catch consisted of mating pairs. It may be that pairing only takes place when the weather conditions are suitable. The minimum temperatures on the 2 nights when pairing was observed were 9°C and 8°C respectively, although the first night was very windy. No pairing was observed before midnight, or in 1987 and 1989.

CONCLUSION

The numbers of *L.n. leechi* vary from year to year. The regrowth of *Elymus farctus* on part of the site has been followed by an increase in the moth population. The population seems to increase in hot, dry summers. The peak population seems to be at the end of August. The low numbers of recaptures is puzzling and suggests that a large number of moths may have been missed in the survey.

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BOOK REVIEWS

Blackflies (Simuliidae), by I. A. Rubtsov. Fauna of the USSR. Vol. 6, Part 6. Second edition, 1956. English translation by Dr B. R. Sharma for Oxonian Press Pvt Ltd, New Delhi, 1990, 1042 pp. Distributed by E. J. Brill, Leiden, 300 Dutch Guilders. A general introductory account is given on the biology of this group of blood-sucking flies, which are a prominent component of the insect fauna in boreal and sub-boreal regions and implicated in transmission of diseases of domestic animals.

Descriptions and keys are provided (to all stages where known) for the 280 species recorded from the USSR at the time of writing and 48 species known from adjacent parts of Europe. The text is well illustrated with diagnostic features of all stages. Information on distribution is supplemented by discussion of the biogeography of genera and species groups.

Rubtsov (or Rubzov as his name is otherwise rendered in English) continued to work on the group and has described many additional species in the intervening years since publication of the Russian edition. He contributed the keys to the Palaearctic species published in Lindner's 'Die Fliegen' series (1959–1964) and was a co-author of the list for the family in the recent Palaearctic catalogue (1988), from which it can be gleaned that more than 400 species of Simuliidae are now recorded from the Soviet Union. In the British Isles we have only 35 species recorded, of which only 23 are dealt with in this work so it is of limited usefulness for identification of the British fauna.

This work was, nevertheless, a thorough synthesis of information on the group and includes a full list of references up to 1955. Although not up to date taxonomically it provides a good summary of knowledge of the family, and a basis for further studies.

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Zoologia Neocaledonica. Volume 2 Mémoires du Museum national d'Histoire naturelle, Paris. Sér. A, tome 149, 1991, 358 pp, Edited by J. Chazeau & S. Tillier, 155 Dutch Guilders, available from Universal Book Services, Dr W. Backhuys, Warmonderweg 80, 2341 KZ Oegstgeest, The Netherlands (mainly in French, some chapters in English).—This includes chapters 15–32 of the results of (mainly in French) expeditions to New Caledonia. Each is a contribution on a different group of animals; most are